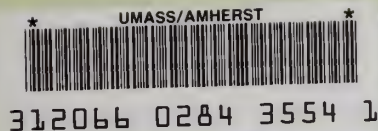


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Hopkinton Intersection Analyses

GOVERNMENT DOCUMENTS
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**Metropolitan Area
Planning Council**

110 Tremont Street
Boston, Massachusetts 02108

February, 1987

Hopkinton Intersection Analyses

December 1986

Metropolitan Area Planning Council
110 Tremont Street
Boston, Massachusetts

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PREFACE

Mr. Robert Bartlett, Hopkinton's Highway Surveyor and the Police Department have reviewed this study and provided comments on the draft. These comments are incorporated as Attachment 1 to the report and into the discussion of recommendations for each intersection.

EXECUTIVE SUMMARY

The town of Hopkinton has requested the Metropolitan Area Planning Council to undertake a review of conditions at several intersections in the town. The town stated that safety and efficiency were the primary reasons for the request for assistance.

It was originally agreed that the MAPC would study five unsignalized intersections in Hopkinton (See Map 1). These intersections were:

1. Wood Street and Main Street;
2. Main Street and Pleasant Street;
3. Main Street and Hayden Rowe Street;
4. West Main Street, High Street and Lumber Street; and
5. Hayden Rowe Street and Grove Street.

The intersection of Hayden Rowe Street and Grove Street was a low priority and was later removed from the study.

The analysis suggests intersection improvements for each of the four intersections. Suggested improvements are summarized below.

1. Wood Street-Main Street

- A) Traffic signalization.
- B) Right-turn lane on Main Street.

2. Main Street-Pleasant Street

- A) Traffic signalization.
- B) Right-turn lane on Main Street.
- C) Left- and right-turn lanes on Pleasant Street.

3. Main Street-Hayden Rowe Street

- A) Traffic signalization.

4. West Main Street-High Street-Lumber Street

- A) Traffic signalization.
- B) Turn lanes on all four approaches to intersection.

Based upon the turning movement counts gathered by the Town of Hopkinton, all four locations meet the conditions of Warrant 9 "Four Hour Volumes" for traffic signals as described in the Manual on Uniform Traffic Control Devices.

It is the desire of the Town of Hopkinton to keep the number of traffic signals in town to a minimum. In order to achieve this goal the town's Highway Surveyor has suggested alternatives for each location. These suggestions have been incorporated as Attachment 1 to the report and into the discussion of recommendations for each intersection. These suggestions are summarized below.

1) Wood Street-Main Street

Redesign this intersection with a new roadway between Wood Street and West Main Street.

2) Main Street-Pleasant Street

Signalize intersection with provisions made for pedestrian phasing and operation of the signal only during the morning and afternoon peak hours.

3) Main Street-Hayden Rowe Street

In place of a traffic signal the town suggests the placement of a traffic island and lane markings for two lanes approaching Main Street on Hayden Rowe Street.

4. West Main Street-High Street-Lumber Street

The Highway Surveyor suggests utilizing a new, private, roadway near I495 for access between Elm Street and West Main Street. This suggestion includes closing High Street at the West Main Street-High Street-Lumber Street intersection.

INTRODUCTION

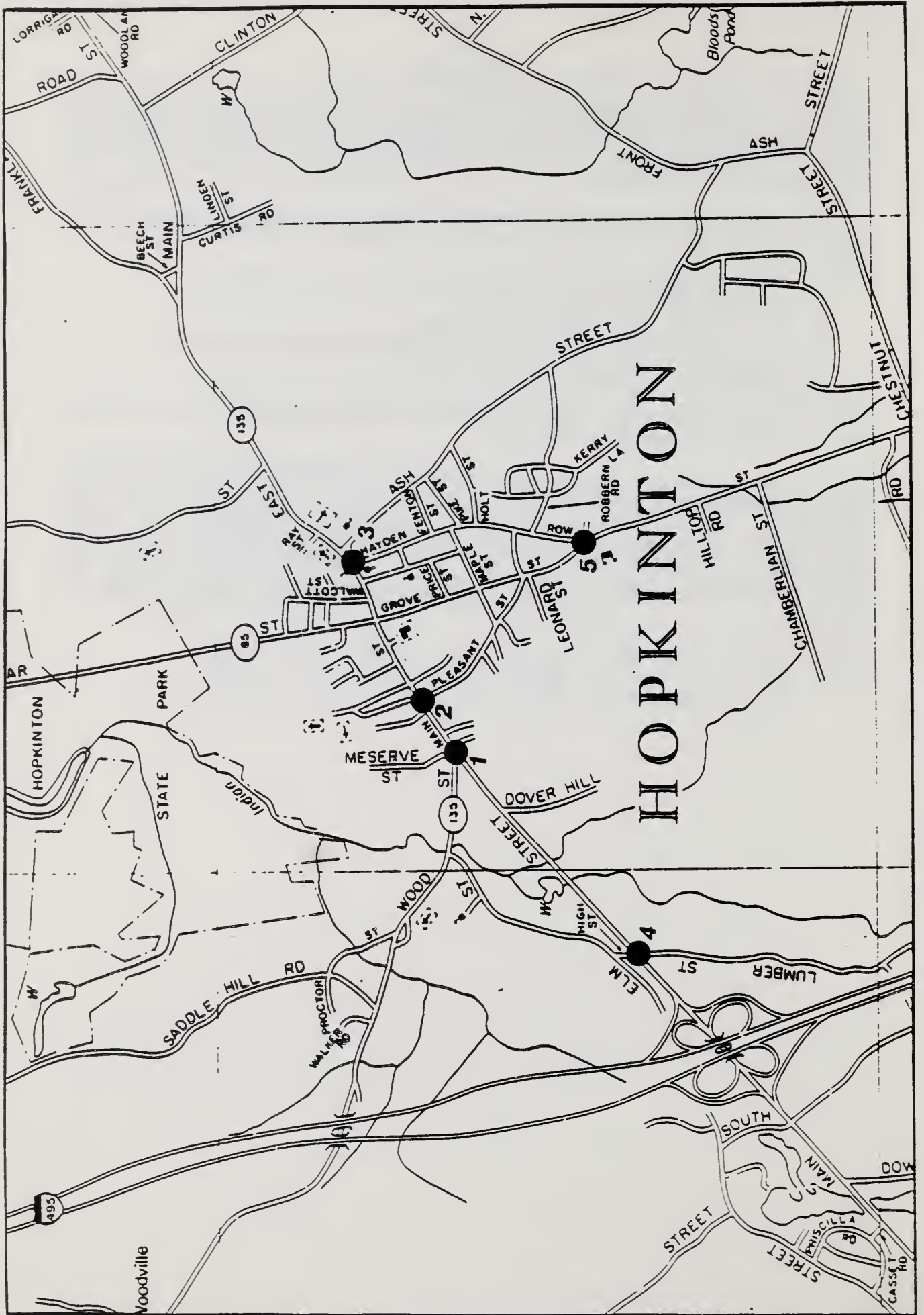
The Town of Hopkinton requested the Metropolitan Area Planning Council to undertake a review of conditions at several intersections in the town. The town stated that safety and efficiency were the primary reasons for the request for assistance.

It was originally agreed that the MAPC would study five intersections in Hopkinton (See Map 1). These intersections were:

1. Wood Street and Main Street;
2. Main Street and Pleasant Street;
3. Main Street and Hayden Rowe Street;
4. West Main Street, High Street and Lumber Street; and
5. Hayden Rowe Street and Grove Street.

The intersection of Hayden Rowe Street and Grove Street was a low priority and was later removed from the study.

The Hopkinton Highway Department provided the MAPC with turning movement data, intersection geometry and accident data for each of the four locations. This data has been used to conduct capacity and safety analyses for each intersection. The analysis was undertaken to determine improvements necessary for existing traffic conditions and then as for 1990 conditions assuming first 1.5% and then 3.0% annual growth in traffic.



Map 1: Locus Map - Hopkinton Intersection Analyses

1. WOOD STREET AND MAIN STREET

Problem Statement

Motorists approaching the intersection of Wood Street and Main Street from Wood Street experience excessive delays.

Intersection Description

The intersection of Wood Street (Route 135) and Main Street is a "Y" intersection (Map 2). While no right turns are made out of Wood Street the intersection meets in such a fashion that these right turns would require a large turning radius. The intersection is located along a steady 5% to 7 1/2% slope rising uphill from the Indian Brook located to the north and west of the intersection.

Existing Traffic Conditions

The Wood Street-Main Street intersection serves 1,621 vehicles during the morning peak hour and 1,626 vehicles during the afternoon peak hour. The major traffic flow at the intersection is from west to east during the morning peak hour, 840 vehicles, and from east to west during the afternoon peak hour, 954 vehicles (Figure 1).

Capacity analysis modeling shows that with current traffic and roadway alignment, excessive delays are experienced at times during both the morning and afternoon peak hours by traffic exiting Wood Street (Table 1). Although traffic at its peak approaches this intersection at a rate of 225 vehicles per hour, from Wood Street, the capacity of that approach is only about 70 vph.² This means that the Wood Street approach operates at a level of service "F during traffic peaks." No delays are experienced along Main Street.

Accidents

According to data provided to the MAPC by the Hopkinton Police Department, two accidents occurred between the beginning of 1982 and the end of 1984 at the Main Street-Wood Street intersection. The Police Department has indicated that both of these accidents were caused by driver error. These two yield an₃ accident rate of 0.11 accidents per vehicle entering the intersection.

²The 225 vehicles represent the "rate of flow." The Institute of Transportation Engineers defines rate of flow as "the equivalent hourly rate at which vehicles pass over a given point or section of a lane or roadway during a given time interval less than one hour, usually 15 minutes" (1985 Highway Capacity Manual).

³A rate of 1.74 accidents per million entering vehicles for signalized intersections has been cited as a statewide norm. ("Final Environmental Impact Report for Cambridgepark Phase 2" Vanasse/Hangen, Inc. citing data from the Massachusetts Department of Public Works).

Plan, of the Wood Street - Main Street Intersection 1

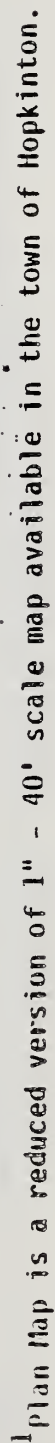


Figure 1

SUMMARY OF VEHICLE MOVEMENTS

Intersection Main Street and Wood Street

Date 9/12/89 Day of Week Thursday Weather Fair Community Hopkinton

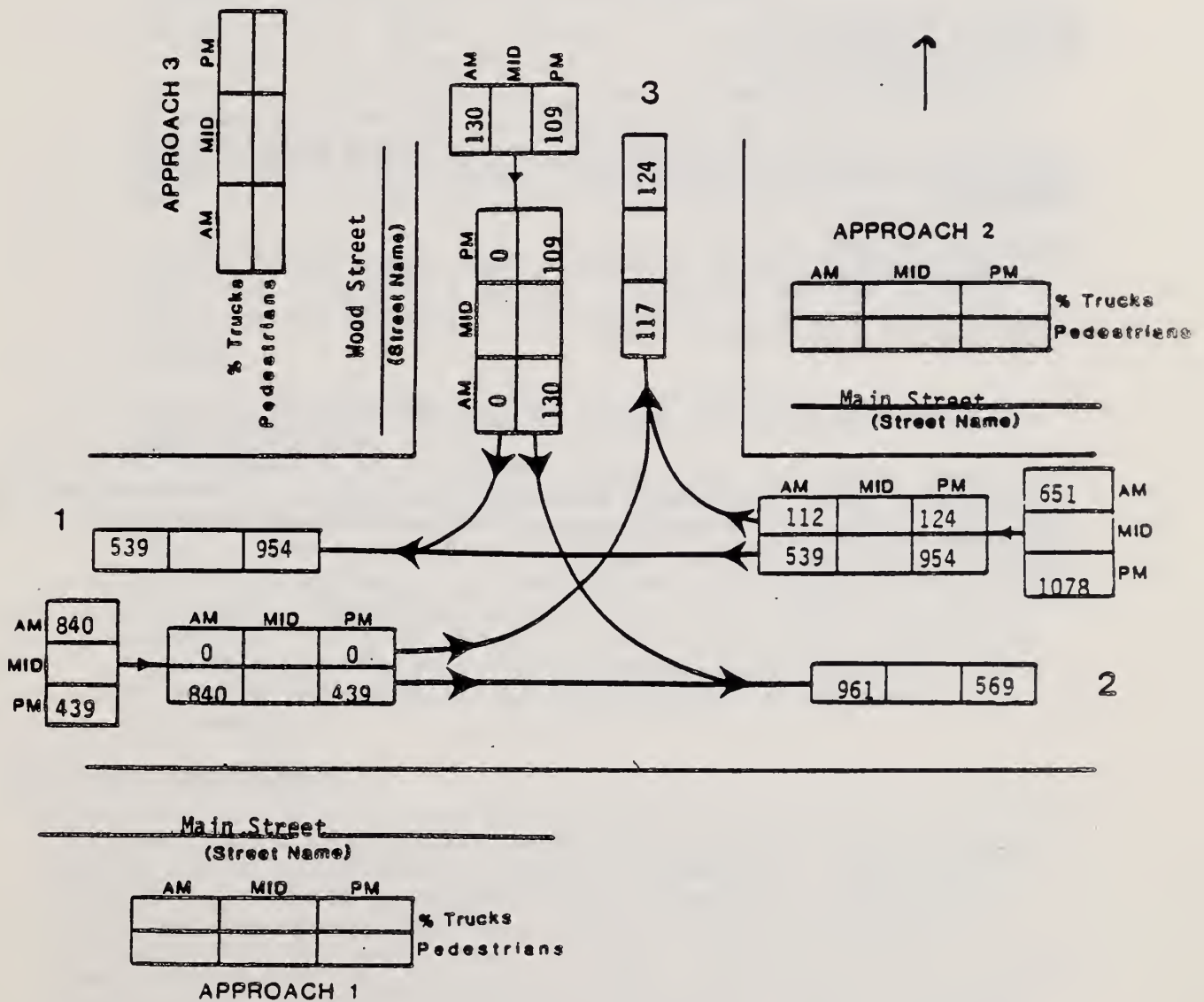


Table 1

CRITICAL MOVEMENT SUMMARY⁴ - WOOD STREET AND MAIN STREET

<u>Existing Conditions</u>	<u>A.M. Peak</u>	<u>P.M. Peak</u>
All Movements Out of Wood Street	F	F
<u>Signalize Intersection on Existing Alignment</u>		
Westbound on Main Street	A	C
Southbound on Wood	F	F
o Intersection L.O.S.	B	C
<u>Signalize Intersection and Add Right-Turn Only Lane on Main Street</u>		
<u>Westbound</u>		
Southbound on Wood Street	D	D
o Intersection L.O.S.	B	B

⁴The Table identifies any movement operating at a Level of Service "C" or worse as being considered a critical movement. Critical movements are those movements in the intersection experiencing lengthy delays in passing through the intersection.

Options to Alleviate Existing Problems

A. Capacity Improvements

A number of alternative improvements to accommodate current traffic conditions at the Wood Street-Main Street intersection have been evaluated. Each of these alternatives was tested to assess the resulting impact on roadway capacity and traffic delay. That analysis indicated that the following options will address some, or all, of the intersection's needs.

1. Signalize Intersection on Existing Alignment

One option would be the placement of a two phase traffic signal at the intersection. Capacity analysis suggests that the intersection could operate at a level of service "C" during the afternoon peak hour and a "B" during the morning peak hour with such a signal. (Table 1). While this option will alleviate movements out of Wood Street, the approach would operate at a level of service "F" (excessive delays) during both peak hours.

Traffic volumes at the Wood Street-Main Street intersection are sufficient to support a Warrant 9 "Four Hour Volume" Traffic Signal Warrant described in the Manual on Uniform Traffic Control Devices.

2. Signalize Intersection and Add a Right-Turn-Only Lane on Main Street Westbound

Another option for improving conditions at the Wood Street-Main Street intersection would be the placement of a two-phase traffic signal at the intersection, and adding a right-turn-only lane on Main Street westbound into Wood Street. The capacity analysis for this type of improvement suggests that the intersection could operate at a level of service "B" during both peak hours of the day (Table 1). The Wood Street approach would operate at level of service "D" during the two peak periods, given these improvements.

B. Safety Improvements

The existing alignment of the intersection creates concern for public safety at the Wood Street-Main Street intersection. The Town of Hopkinton may desire to reconstruct, or relocate, the intersection such that Wood Street meets Main Street at an angle nearer 90 degrees. This work would result in fewer vehicles entering or exiting Wood Street encroaching on opposing travel lanes when making turns. The available accident data for this intersection does not suggest, however, that this improvement would have prevented the two accidents at the intersection. Due to the location of a home in close proximity to this intersection, realignment of the existing intersection does not appear practical.

1990 Traffic Implications

The Wood Street-Main Street intersection has been reviewed to determine what, if any, additional improvements are necessary for 1990 Traffic conditions. Two traffic growth scenarios have been used for this analysis, assuming 1.5% and 3.0% annual growth rates.

A. 1.5% Annual Growth

A 1.5% annual growth rate in traffic in the Town of Hopkinton would result in the need for a traffic signal and a right-turn-only lane on Main Street westbound into Wood Street. The capacity analyses for these traffic conditions indicate that the intersection, overall, would operate at a level of service "B", with no approach operating at worse than "D" during either peak hour (Appendix A-7 & A-8).

B. 3.0% Annual Growth

A 3.0% annual growth rate in traffic would result in the need for a traffic signal and the addition of a right-turn-only lane on Main Street westbound into Wood Street. The capacity analysis for these traffic conditions indicate that the intersection would operate at a service "B" (Appendix A-9 & A-10). The Wood Street approach will operate at a level of service "E" during the morning peak hour.

Summary

The Wood Street-Main Street intersection traffic volumes create excessive delays for vehicles utilizing the Wood Street approach. These delays result in a level of service "F" for this approach.

Accident data at the intersection does not identify any particular safety problem.

The analysis of conditions reveals that delay can be decreased through the placement of a traffic signal at the intersection. A right-turn lane on Main Street will further improve traffic conditions along Wood Street (See Table 1).

Recommendations

Capacity analysis of existing and potential future traffic conditions for the Wood Street-Main Street intersection suggests improvements would expedite traffic flow at the intersection. These improvements should include, at minimum, placement of a traffic signal at the intersection. A right-turn lane on Main Street is also advisable for the existing traffic conditions.

The Hopkinton Highway and Police Departments feel that this intersection should be redesigned with a new roadway being built between Wood Street and West Main Street (see Attachment 1). This recommendation would require additional analysis in relation to its impact on surrounding locations.

2. MAIN STREET AND PLEASANT STREET

Problem Statement

Traffic along Main Street, at its intersection with Pleasant Street, provides few opportunities for vehicles exiting Pleasant Street to enter the stream of traffic. This results in excessive delays on Pleasant Street during morning and evening peak hours.

Intersection Description

The intersection of Main Street (Route 135) and Pleasant Street is a "T" intersection (Map 3). The intersection is currently controlled by a stop sign on Pleasant Street. The intersection is located along a 4 1/2 percent uphill grade from The Indian Brook located to the west of the intersection.

Existing Traffic Conditions

The Main Street-Pleasant Street intersection serves 1,641 vehicles during the morning peak hour and 1,671 vehicles during the afternoon peak hour (Figure 2). The major traffic flow at the intersection is eastbound during the morning peak hour, 961 vehicles, and westbound during the afternoon peak hour, 984 vehicles.

A capacity analysis of the intersection reveals that excessive delays are experienced by traffic attempting to exit Pleasant Street during the morning and afternoon peak hours (Table 2). The Pleasant Street approach is used by approximately 250 vehicles during the morning peak hour and 120 vehicles during the afternoon peak hour, however the capacity for the approach is only about 100 vehicles per hour.

Accident Data

There were no reported accidents for this location for the years 1982 through 1984.

Options to Alleviate Existing Problems

A. Capacity Improvements

A number of alternative improvements were tested for the traffic conditions at the Main Street-Pleasant Street intersection. Capacity analysis suggests the following options will address some, or all, of the intersection's needs.

1. Signalize Intersection With Existing Travel Lanes

Delays at the Main Street-Pleasant Street intersection would be somewhat relieved by the placement of a two-phase traffic signal at the intersection. With a two phase traffic signal, the intersection would operate at level of service "B" during the afternoon peak (Table 2). However, a level of service "E" would prevail at the intersection during the morning peak (Table 2). The Pleasant Street approach, under these conditions, would continue to operate at a level of service "F" during the morning peak, but would improve to a "D" during the afternoon peak.

Map 3



11.) Elevations refer to mean sea



plan is a reduced version of a 1"-20" scale map available in the town of Hopkinton.

Figure 2

SUMMARY OF VEHICLE MOVEMENTS

Intersection Main Street and Pleasant Street

Date 9/17/85 Day of Week Tuesday Weather Fair; sunny Community Hopkinton
 PM 12/16/85 Monday

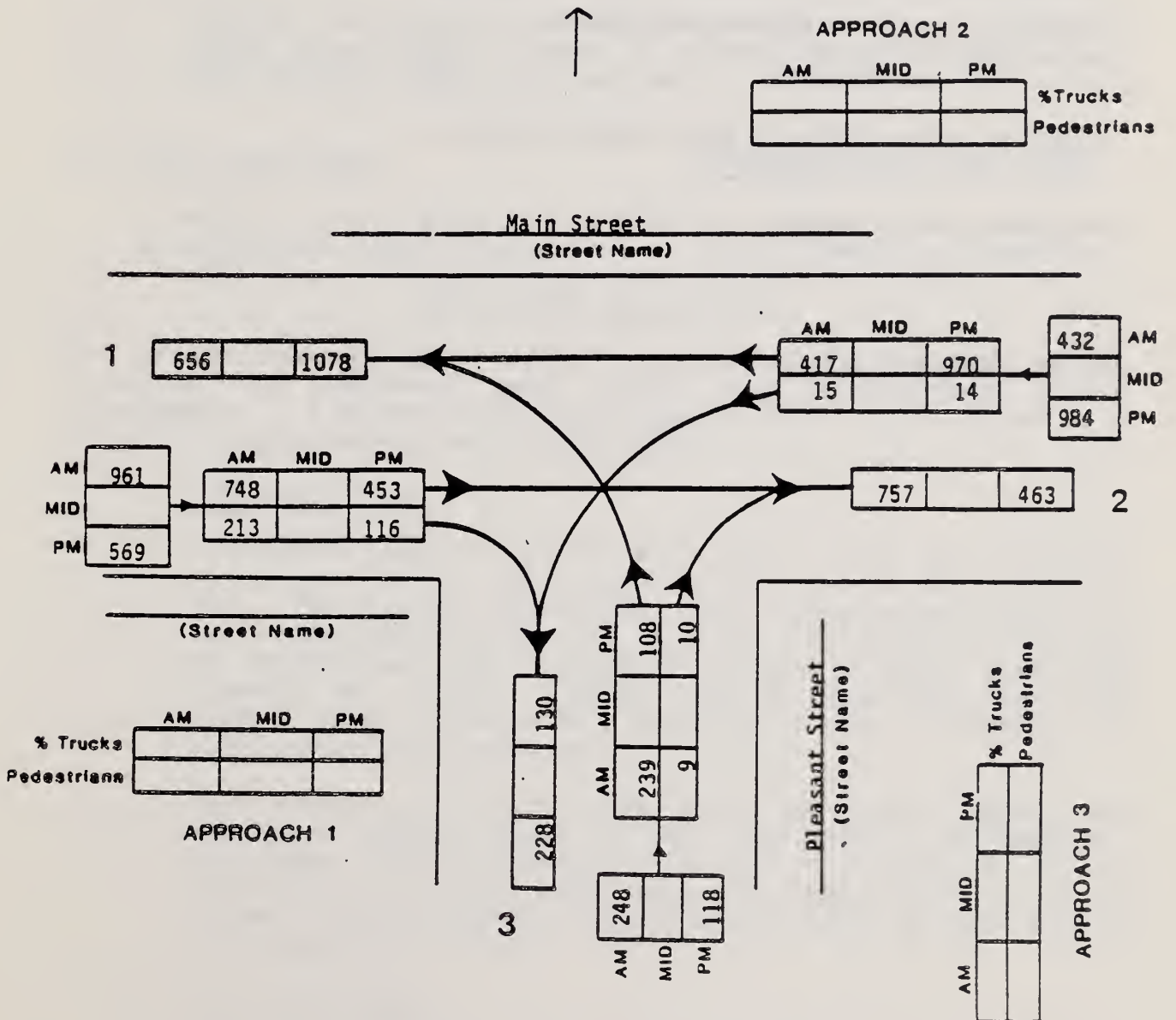


Table 2

CRITICAL MOVEMENT SUMMARY - MAIN STREET AND PLEASANT STREET

<u>Existing Conditions</u>	<u>AM Peak</u>	<u>PM Peak</u>
All moves from Pleasant Street	F	F
<u>Signalize Intersection With Existing Travel Lanes</u>		
Eastbound through traffic on Main Street	E	A
Northbound on Pleasant Street	F	D
o Intersection LOS	E	B
<u>Signalize Intersection and Add a Right-Turn-Only Lane on Main Street Eastbound</u>		
Eastbound on Main Street	C	A
Northbound on Pleasant Street	D	D
o Intersection LOS	B	B

* See Footnote 4 on page 6.

Traffic volumes at the Main Street-Pleasant Street intersection are sufficient to support a Warrant 9 "Four Hour Volume" Traffic Signal Warrant described in the Manual on Uniform Traffic Control Devices.

2. Signalize Intersection and Add a Right-Turn-Only Lane on Main Street Eastbound

The addition of a 2-phase traffic signal and a right-turn-only lane on Main Street eastbound is another option available for this intersection.

Capacity analysis for this alternative suggests that, the Pleasant Street approach would operate at a level of service "D" during both peak hours with these improvements. (Table 2).

B. Safety Improvements

As mentioned above, there is no documented safety problem at the Main Street-Pleasant Street intersection.

1990 Traffic Implications

Two growth scenarios have been utilized to estimate the 1990 traffic conditions and improvement needs for the Main Street-Pleasant Street intersection, a 1.5% and a 3.0% annual growth rate. The following is a discussion of the implications of this growth.

1. 1.5% Annual Growth

1.5% annual growth in traffic would result in at least the need for a traffic signal and a right-turn-only lane on Main Street by 1990. The capacity analysis for these conditions indicates that the intersection would operate at a level of service "C" during the morning peak hour and "B" during the afternoon peak hour (Appendix B-7 & B-8). During both of these peak hours the Pleasant Street approach would operate at a level of service "E," experiencing very long delays.

These delays on Pleasant Street could be reduced through the addition of separate right and left turn lanes on its approach. The changes would also result in a level of service "B" at the intersection during both peak hours, the longest delays being on Pleasant Street at level of service "D" during the morning peak hour (Appendix B-9 & B-10).

2. 3.0% Annual Growth

In order to accomodate 3% annual growth in traffic a traffic signal, the addition of a right-turn lane on Main Street and separate right and left turn lanes on Pleasant Street will be

needed by 1990. The capacity analysis suggests that the intersection would operate at a level of service "C" during the morning peak hour and a "B" during the afternoon peak (Appendix B-11 & B-12). The Pleasant Street approach would operate at an "E" during the morning peak and a "D" during the afternoon under these conditions.

Summary

Traffic at the Main Street - Pleasant Street intersection creates excessive delays for vehicles exiting Pleasant Street. This means that Pleasant Street presently operates at a level of service "F".

The above analysis of the intersection suggests that a traffic signal and a right-turn-only lane on Main Street are necessary for existing traffic. In order for the intersection to serve 1990 traffic volumes separate left- and right-turn lanes will be necessary on Pleasant Street.

Recommendations

Capacity analysis of existing and potential traffic conditions for the Main Street-Pleasant Street intersection suggests that signalization is in order. It is advisable that improvements to the intersection also include a right-turn-only lane on Main street and separate left and right turn lanes on Pleasant Street to accommodate 1990 traffic.

The Town of Hopkinton Highway Surveyor and Police Department agree that a traffic signal is necessary at this intersection (see Attachment 1). The town would like to see the signal include pedestrian phasing and be operational only during the morning and afternoon peaks. Traffic data available for the Main Street-Pleasant Street intersection only provides four hours of data and no pedestrian information. Twenty-four hour machine counts for traffic and manual pedestrian counts will be necessary to determine if additional Traffic Signal Warrants, beyond a Warrant 9 "Four Hour Volume" Warrant, are met.

3. MAIN STREET AND HAYDEN ROWE STREET

Problem Statement

A capacity problem exists at the intersection of Main Street and Hayden Rowe Street for left turning traffic out of Hayden Rowe Street. Excessive delays are experienced by motorists making this turn during the afternoon peak hour.

Intersection Description

The intersection of Main Street and Hayden Rowe Street is a "T" intersection (Map 4). Pavement widths range from 50 feet up to 85 feet on the three approaches to the intersection. These widths provide ample room for existing on-street parking. A slight grade, ranging from 1% to 3%, is present at the intersection. The Hayden Rowe Street approach is on a downgrade and on the two Main Street approaches to the intersection are on uphill grades.

Existing Traffic Conditions

The Main Street-Hayden Rowe Street intersection serves 1,413 vehicles during the morning peak hour and 1,516 vehicles during the afternoon peak. The major traffic flow at the intersection is eastbound in the morning, 636 vehicles, and westbound in the afternoon, 989 vehicles (Figure 3).

The capacity analysis for this intersection reveals that long delays occur on Hayden Rowe Street for left turns during the morning peak hour, level of service "E" (Table 3). Excessive delays occur for left turns during the afternoon peak hour for traffic on Hayden Rowe Street, i.e. the demand exceeds the capacity at the intersection (Table 3).

Accidents

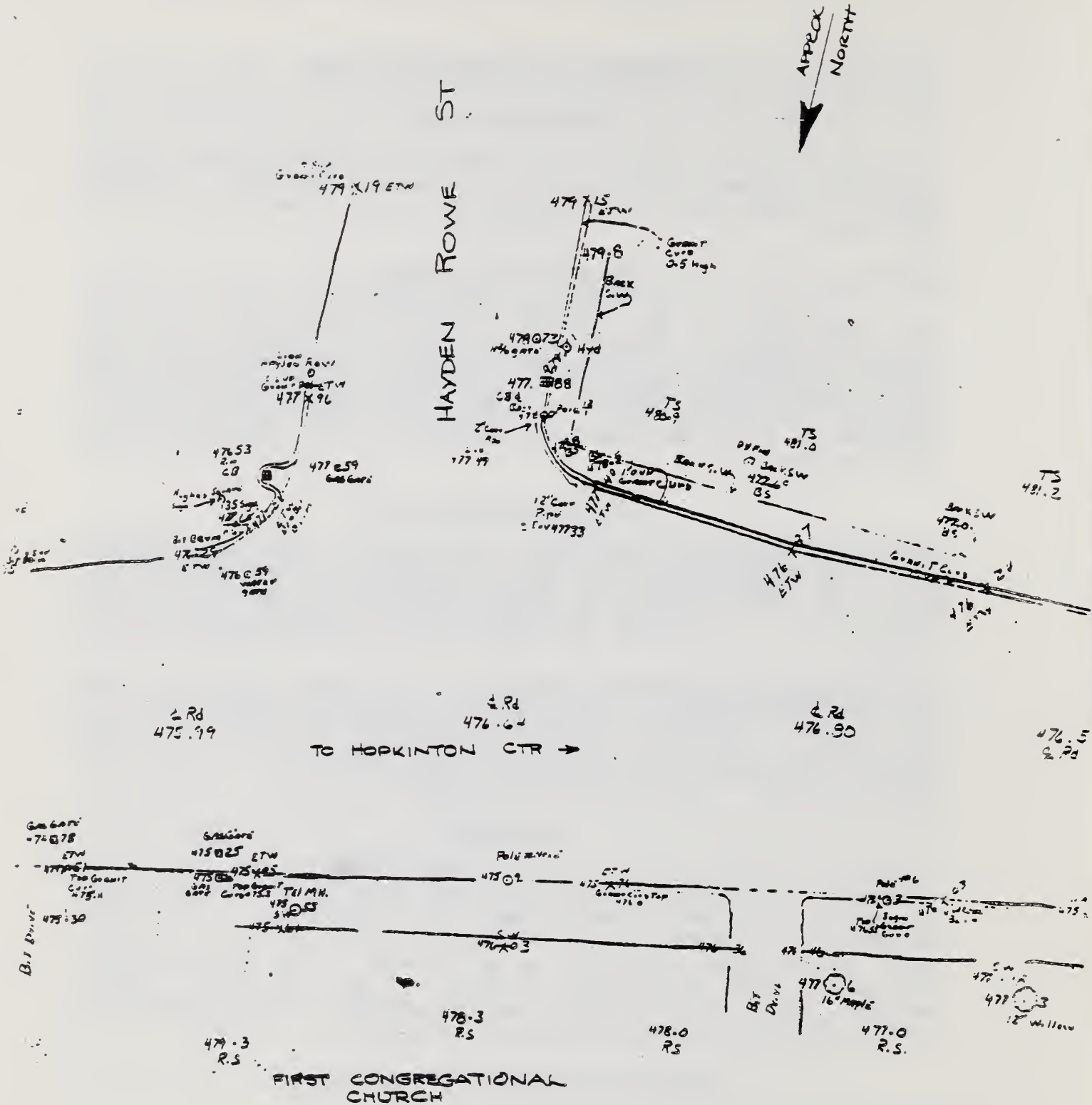
According to accident data provided to the MAPC by the Hopkinton Police Department, 5 accidents occurred between the beginning of 1982 and the end of 1984 at the Main Street-Hayden Rowe intersection. The Police Department has identified four of these accidents as involving driver error and the fifth as being due to wet pavement. Three of the accidents occurred in 1982 and one each occurred in 1983 and 1984. These 5 accidents result in a relatively low accident rate of 0.30 accidents per million entering vehicles (see Footnote 3 on page 3).

Options to Alleviate Existing Problems

A. Capacity Improvements

Capacity analysis suggests that the following improvement will address some, or all, of the intersection's needs.

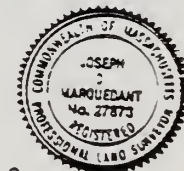
Plan of the Main Street-Hayden Rowe Intersection⁶



NOTES:

1) Elevations refer to mean sea level

⁶ plan is a reduced version of a 1"-20" scale map available in the town of Hopkinton.



EXISTING EAST

SCALE: 1" = 2'

PREP FOR:

PREP BY: J.D.

Figure 3

SUMMARY OF VEHICLE MOVEMENTS

Intersection Main Street at Hayden Rowe Street

Date 9/24/85 Day of Week Tuesday Weather Rain Community Hopkinton



APPROACH 2

AM	MID	PM	% Trucks
			Pedestrians

Main Street
(Street Name)

1 432 805

AM	MID	PM
374		759
42		230

416	AM
	MID
989	PM

AM	636
MID	
PM	379

AM	MID	PM
604		332
32		47

907 434 2

(Street Name)

% Trucks	AM	MID	PM
Pedestrians			

APPROACH 1

3

74

AM	58
MID	
PM	303

AM	361
MID	
PM	148

Hayden Rowe Street
(Street Name)

% Trucks	AM	MID	PM
Pedestrians			

APPROACH 3

1. Signalize Intersection

Traffic using Main Street-Hayden Rowe Street intersection would receive immediate relief through the placement of a two-phase traffic signal at the intersection. Capacity analysis suggests that such a signal, would allow the intersection to operate at a level of service "A" in the morning peak and a "B" during the afternoon peak (Table 3).

Traffic volumes at the Main Street-Hayden Rowe Street intersection are sufficient to support a Warrant 9 "Four Hour Volume" traffic signal warrant described in the Manual on Uniform Traffic Control Devices.

B. Safety Improvements

Based upon the description of the accidents provided by the Hopkinton Police Department driver error is the predominant cause of accidents at the intersection. Proper use of lanes and care in turning are specifically cited as causes in two of the accidents. The use of a traffic signal along with lane striping and marking may alleviate these types of accidents.

1990 Traffic Implications

As with the preceding intersections, the intersection of Main Street and Hayden Rowe Street has been reviewed to determine what, if any, additional improvements are necessary for 1990 traffic conditions. Two traffic growth scenarios have been used for this analysis, with 1.5% and 3.0% annual growth rates.

A. 1.5% Annual Growth

A 1.5% annual growth rate in traffic in the Town of Hopkinton for 1990 would indicate the need for a traffic signal at the Main Street-Hayden Rowe Street intersection as indicated in the existing condition's analysis. (Appendix C-5 & C-6).

B. 3.0% Annual Growth

A 3.0% annual growth rate in traffic for 1990 would not indicate that any further improvements beyond what is recommended for the existing traffic condition would be necessary. (Appendix C-7 & C-8).

Summary

The traffic utilizing the Hayden Rowe Street approach to Main Street experiences delays when attempting to make left turns during the afternoon peak. Capacity analysis suggests the need for a traffic signal to alleviate this condition.

Recommendations

Capacity analysis of existing and potential future traffic conditions suggests that a two phase traffic signal would adequately serve traffic at the Main Street-Hayden Rowe Street intersection.

Table 3

CRITICAL MOVEMENT SUMMARY - MAIN STREET AND HAYDEN ROWE STREET

<u>Existing Conditions</u>	<u>AM Peak</u>	<u>PM Peak</u>
Left Turns from Hayden Rowe Street	E	F
<u>Signalize Intersection</u>		
Northbound on Hayden Rowe o Intersection LOS	A A	A A

The Town of Hopkinton Highway Surveyor suggests that this intersection not be signalized (Attachment 1). In place of a signal he suggests placement of a traffic island and pavement markings for two lanes approaching Main Street on Hayden Rowe Street. Due to the pavement width at this intersection, this condition was originally tested resulting in levels of service "E" and "F" for left turns during the morning and afternoon peak hours respectively for left turns out of Hayden Rowe Street. However, all other movements at the intersection operate at an L.O.S. of "B" or better during the peak hours. Considering the number of vehicles effected by the delay at the intersection, 58 in the a.m. peak and 46 during the p.m. peak hour, the town may be justified in delaying signalization at this time to determine the impact of surrounding improvements on Main Street-Hayden Rowe Street traffic. An engineering study should review the possibilities for either narrowing Main Street at this intersection or better channelizing traffic at the intersection.

4. WEST MAIN STREET, HIGH STREET AND LUMBER STREET

Problem Statement

Capacity problems exist at the West Main Street-High Street-Lumber Street intersection for traffic attempting to exit Lumber Street and High Street.

Intersection Description

The intersection of West Main Street, High Street and Lumber Street is a four leg intersection (Map 5). The intersection is laid out such that right turns into High Street and Lumber Street may require wide large turns. The intersection is located along fairly level terrain with a grade of less than 1 percent on all four approaches.

Existing Traffic Conditions

The West Main Street-High Street-Lumber Street intersection serves 1,571 vehicles during the morning peak hour and 1,577 vehicles during the afternoon peak hour (Figure 4). The major traffic flow at the intersection is from west to east during the morning peak hour, 799 vehicles, and from east to west during the afternoon peak hour, 848 vehicles.

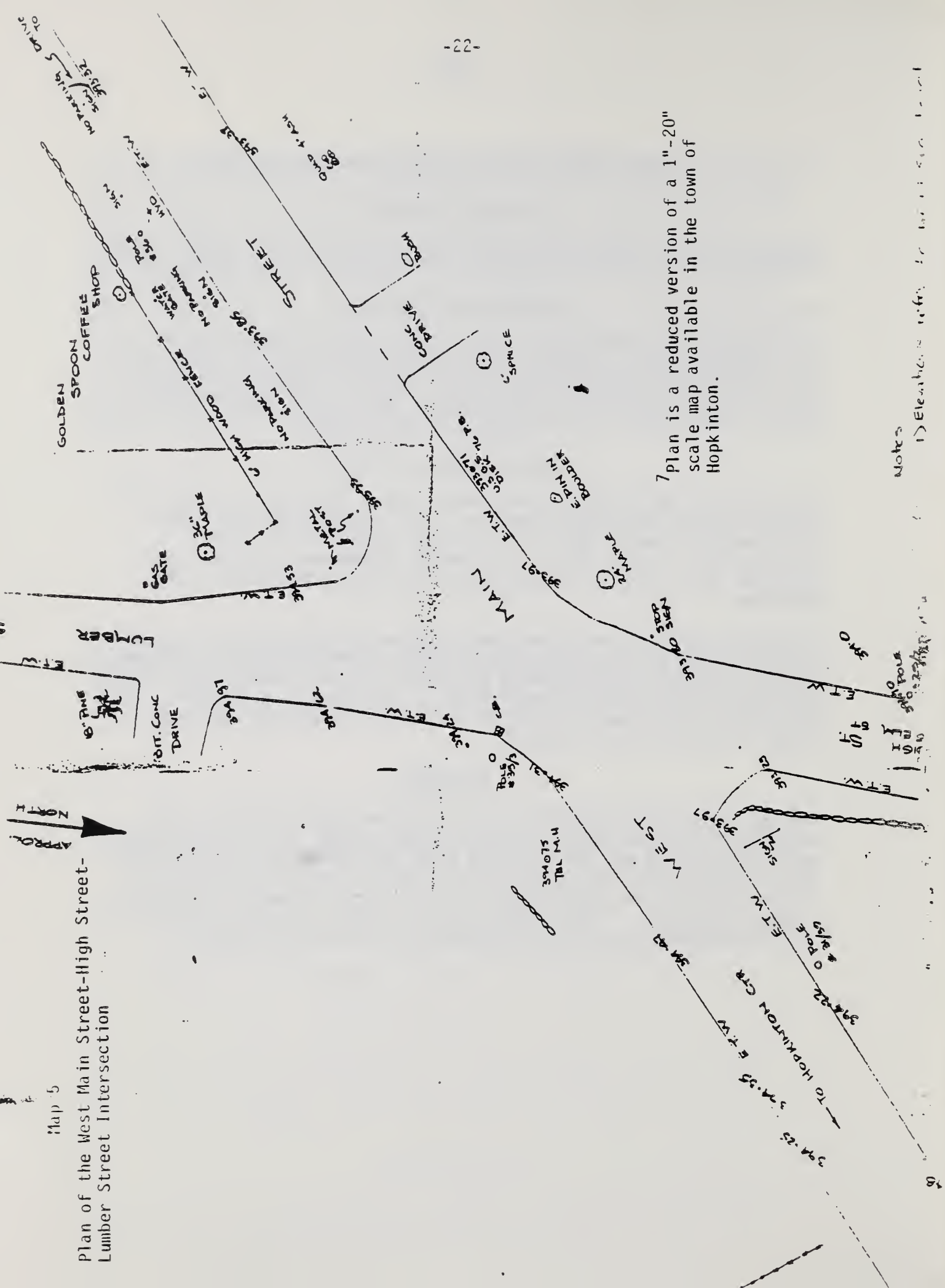
Although traffic volumes using Lumber Street is relatively low, capacity analysis shows that, with existing traffic volumes and roadway alignment, excessive delays are experienced by traffic exiting Lumber Street during both peak hours, (level of service "F"). There are also extremely long delays for traffic exiting High Street during the morning peak hour, (level of service "E") (Table 4).

Accidents

The Hopkinton Police Department has identified eight accidents which occurred at the West Main Street-High Street-Lumber Street intersection during 1982, 1983 and 1984. Of the eight accidents, two were attributed to excessive speed, one to failing to stop at a stop sign, one to the failure to grant the right-of-way, one to faulty equipment and two to roadway conditions. These eight accidents result in an accident rate of 0.46 accidents per million entering vehicles (see Footnote 3).

chap. 5

Plan of the West Main Street-High Street-Lumber Street Intersection



7 plan is a reduced version of a 1"-20" scale map available in the town of Hopkinton.

Notes:

1) Elementen: $1, 2, 3, 4, 5, 6, 7, 8, 9, 10$

Figure 4

SUMMARY OF VEHICLE MOVEMENTS

Intersection West Main Street, High Street and Lumber Street

Date 9/11/85 Day of Week Wednesday Weather Fair/sunny Community Hopkinton
 PM 8/13/86 Wednesday

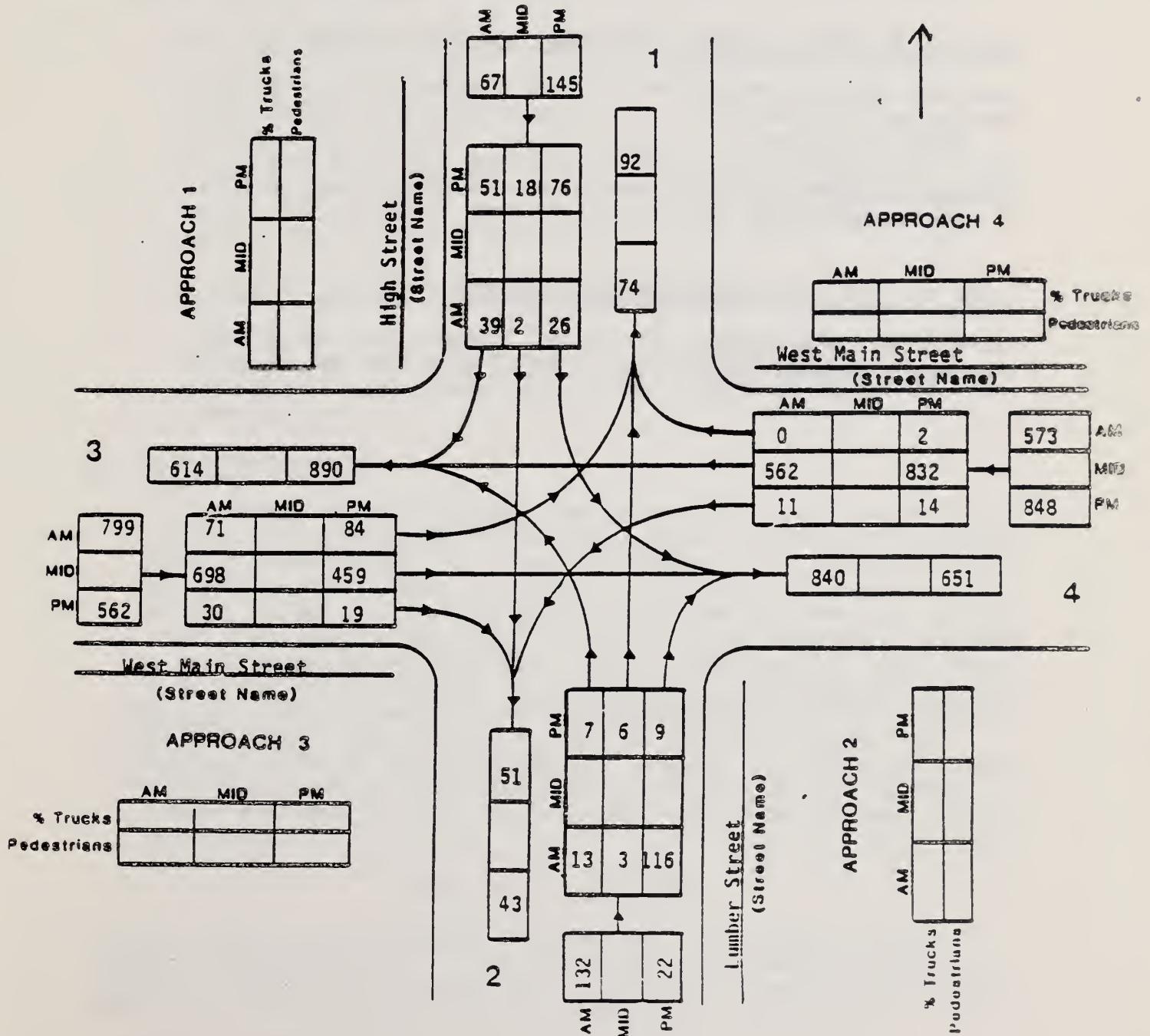


Table 4

Critical Movement Summary - West Main Street,
High Street and Lumber Street

<u>Existing Conditions</u>	<u>AM Peak</u>	<u>PM Peak</u>
All moves from High Street	E	D
All moves from Lumber Street	F	F
<u>Add Left-Turn-Only Lanes of High Street and Lumber Street</u>		
Left turn from High Street	E	E
Through and Right Turns from High Street	C	C
Left turns from Lumber Street	E	F
Through and Right Turns from Lumber Street	B	B
<u>Signalize Intersection on Existing Alignment</u>		
Southbound on High Street	D	C
Northbound on Lumber Street	C	D
o Intersection LOS	B	B

Options to Alleviate Existing Problems

A. Capacity Improvements

A number of alternative improvements were identified for the existing traffic conditions at the West Main Street-High Street-Lumber Street intersection. Each of these alternatives were tested to identify the resulting impact on roadway capacity and delay. Capacity analysis suggested the following options will address some, or all, of the intersection's needs.

1. Add Left Turn Only Lanes on High Street and Lumber Street

Capacity analysis suggests that the addition of left turn only lanes on High Street and Lumber Street could result in improvements in traffic conditions such that the only movement that would experience excessive delays, level of service "F," would be the left turns out of Lumber Street during the afternoon peak. All other left turns would experience long delays, level of service "E," during both peak hours (Table 4).

2. Signalize Intersection on Existing Alignment

Capacity analysis suggests that the use of a two phase traffic signal at the West Main Street-High Street-Lumber Street intersection could provide for a level of service "B" at the intersection.

B. Safety Improvements

The Hopkinton Police Department reported that all of the accidents at the West Main Street-High Street-Lumber Street intersection were the result of driver error. It is very difficult, if not impossible, to make roadway improvements to correct for driver error. However, failure to stop or failure to grant right-of-way accidents may reflect insufficient gaps in the traffic flow for turning movements to be made to and from the minor approaches. Traffic signalization, which might be justified under Warrant 2 in the Manual on Uniform Traffic Control Devices (MUTCD) "Interruption of Continuous Traffic"⁸, could provide for these gaps. Data is not available to determine whether the intersection meets this MUTCD warrant. However, for the 4 hours that counts were taken at this intersection, Warrant 2 was met and these volumes also meet standards for a Warrant 9 "Four Hour Volume" traffic signal warrant.

1990 Traffic Implications

The West Main Street-High Street-Lumber Street intersection has been reviewed to determine what, if any, additional improvements would be necessary for 1990 traffic conditions. Two traffic growth scenarios have been used for this analysis, 1.5% and a 3.0% annual growth rate.

⁸ The Manual on Uniform Traffic Control Devices describes a Warrant 2 "Interruption of Continuous Traffic" signal as one for "operating conditions where the traffic volume on the major street is so heavy that traffic on a minor intersecting street suffers excessive delays."

A. 1.5% Annual Growth

A 1.5% annual growth rate in traffic in the Town of Hopkinton would result in a level of service "B" for the afternoon peak hour if a two-phase traffic signal is used at the intersection (Appendix D-9). This drops from a level of service "B" for the morning peak in 1985 to a level of service "C" (Appendix D-10). There will be delays during both peaks. In the morning, Lumber Street will operate at "E" and during the afternoon High Street will operate at "D."

The addition of a right-turn-only lane on Lumber Street for 1990 traffic conditions would result in operation at a level of service "B" during both peak hours (Appendix D-11 & D-12). The approach experiencing the greatest delay with these improvements would be High Street operating at level of service "D" during the afternoon peak.

B. 3.0% Annual Growth

A 3.0 % annual growth rate in traffic would result in the need for additional roadway widening. The addition of left-turn lanes on West Main Street eastbound and westbound as well as on High Street and a right-turn lane on Lumber Street in combination with a traffic signal will provide for a level of service "B" for both peak hours at the intersection (Appendix D-13 & D-14).

Summary

Traffic attempting to exit either Lumber Street or High Street at their intersection with West Main Street experience long delays during both the morning and afternoon peak hours.

Accident data at the intersection reflects the problems identified in the capacity analysis; i.e. difficulties for traffic entering or exiting the stream of traffic.

In order to improve capacity and safety at the intersection Hopkinton should consider the installation of a traffic signal as well as construction of turn lanes on all four approaches.

Recommendations

Capacity analysis of existing and potential future traffic conditions for the West Main Street-High Street-Lumber Street intersection suggests improvements are necessary for the intersection. These improvements should include, at minimum, the installation of a traffic signal at the intersection. Hopkinton should also strongly consider the addition of turn lanes on all four approaches to the intersection.

The Hopkinton Highway Surveyor suggests utilizing a new, private roadway as an access between Elm Street and West Main Street as an alternative to signalizing the West Main Street-High Street-Lumber Street intersection (Attachment 1). This suggestion would include closing High Street at the existing intersection with West Main Street and Lumber Street. This suggestion should be studied in conjunction with the proposed new road between Wood Street and West Main Street and other traffic circulation changes.

SUMMARY OF RECOMMENDATIONS

The above analysis suggests that intersection improvements are necessary for each of the four intersections. Suggested improvements are summarized below.

1. Wood Street-Main Street

- A) Capacity analysis of existing and potential future traffic conditions for the Wood Street-Main Street intersection suggests, at minimum, placement of a traffic signal at the intersection. A right-turn lane on Main Street is also advisable for the existing traffic conditions.

2. Main Street-Pleasant Street

- A) Capacity analysis for the Main Street-Pleasant Street intersection suggests that signalization is in order.
- B) It is advisable that improvements to the intersection also include a right-turn-only lane on Main Street and separate left and right turn lanes on Pleasant Street.

3. Main Street - Hayden Rowe Street

- A) Capacity analysis suggests that a two-phase traffic signal would adequately serve traffic at the Main Street-Hayden Rowe Street intersection.

4. West Main Street-High Street-Lumber Street

- A) Capacity analysis for the West Main Street-High Street-Lumber Street intersection suggests, at minimum, the installation of a traffic signal at the intersection.
- B) Hopkinton should also strongly consider the addition of turn lanes on all four approaches to the intersection.

Based upon the turning movement counts gathered by the Town of Hopkinton, all four locations meet the conditions of Warrant 9 "Four Hour Volumes" for traffic signals as described in the Manual on Uniform Traffic Control Devices.

It should be noted that no attempt has been made to determine the cost of the suggested improvements for these intersections. Costs should be developed as a part of intersection design for the improvements selected.

Upon review of draft Hopkinton Intersection Analysis of October 1986, the Hopkinton Highway Surveyor and Police Department stated a desire to keep the number of traffic signals in town to a minimum (Attachment 1). In a letter to the MAPC the Highway Surveyor made suggestions for each intersection. These comments have been incorporated into the Recommendations section for each intersection as the town's suggestions for the intersection. These suggestions are summarized below.

1. Wood Street-Main Street

- A) Redesign this intersection with a new roadway between Wood Street and West Main Street.

2. Main Street-Pleasant Street

- A) Signalize intersection with provisions made for pedestrian phasing and operation of the signal only during the morning and afternoon peak hours.

3. Main Street-Hayden Rowe Street

- A) In place of a traffic signal the town suggests the placement of a traffic island and lane markings for two lanes approaching Main Street on Hayden Rowe Street.

4. West Main Street-High Street-Lumber Street

- A) The Highway Surveyor suggests utilizing a new, private roadway near I495 as an access between Elm Street and West Main Street. This suggestion includes closing High Street at the West Main Street-High Street-Lumber Street intersection.

The town's suggestions for the Main Street-Pleasant Street and Main Street Hayden Rowe Street intersections appear to be practical if some delay is acceptable to the town for turning movements out of side streets that intersect with Main Street.

Based upon the suggestions for High Street and Wood Street, the town should pursue an engineering study analyzing traffic circulation needs for existing and future growth traffic conditions. This study should incorporate traffic circulation and potential diversions along Wood Street, Elm Street, High Street, Lumber Street, South Street and West Main Street. The study should analyze the potential for new roads such as the one recommended by the Hopkinton Highway Surveyor linking Wood Street to West Main Street as well as possibly linking Lumber Street to South Street, and the closing of select intersections along West Main Street.

The Transportation Improvement Program (TIP) for the Boston region is currently oversubscribed. Many more projects exist in the TIP than can be funded in the next 5 years. The Town of Hopkinton should establish priorities for the improvements along Main Street. This prioritizing process will identify which projects the town should pursue through the TIP process and which projects the town may wish to fund on its own.

Attachment 1

Letter from Hopkinton Highway Surveyor



TOWN OF HOPKINTON

OFFICE OF HIGHWAY DEPARTMENT

HOPKINTON, MASS. 01748

November 14, 1986

Mr. Daniel J. Fortier
Transportation Planner
Metropolitan Area Planning Council
110 Tremont St.
Boston, Mass. 02108

Dear Mr. Fortier:

The Police Department and myself have reviewed your study of our intersection problems. We are indeed grateful for your participation and assistance. Before meeting with the Board of Selectmen on these issues I just want to share with you our thoughts.

We all agree that we do wish to keep the number of traffic signals in town to a minimum. With that in mind we thought that the intersection of Hayden Rowe and Main Street could be handled better with a traffic island and pavement markings allowing two lanes northbound as you approach Main Street from Hayden Rowe. Perhaps further study is needed.

A traffic light at Pleasant and Main would be appropriate and also a pedestrian cross ability built in. At this time, these lights would probably be used during the morning and afternoon rush and left on flash during the other hours, except for pedestrian crosses.

The intersection of Wood and West Main Street, we believe, should be redesigned with a new road built between Wood Street and West Main Street for westbound traffic. This will, of course, require much more study.

We also feel that utilization of a new roadway already constructed between Elm Street and West Main Street near Pte. 495 would be better than installing lights at West Main, Lumber and High Streets. By using the new roadway we could close off High Street and eliminate this serious intersection approach. Here again, further study is needed as the new road I refer to is private property. The owners

of the new roadway are willing to assist us in addressing these problems. Also, this intersection would require traffic control devices as you recommend.

At this time I would like to know if further funding or any type of further assistance is available to us to pursue these ideas and traffic control device installations? If you could provide us with recommendations on where we go from here I would be very grateful and also keep moving on this as soon as possible.

Thank you very much for all that you have provided for us . With this assistance I am confident that we can address these problems early on.

Sincerely,

Robert H. Bartlett
Highway Surveyor

RB/is

cc: Pennv Manchester MAPC Rep.
Chief Bowker

